

RESEARCH

AND

DEVELOPMENT

BOARD



THE NATIONAL MILITARY ESTABLISHMENT
RESEARCH AND DEVELOPMENT BOARD
WASHINGTON, D. C. • 17 JUNE 1949

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FOREWORD

This booklet lists the members of the Research and Development Board and the Executive Council, with short biographical sketches, and includes a list of chairmen of Committees and Panels.

Brief statements of the functions of the Board and the Committees are also presented.

A register, which will include biographical data on chairmen and executive directors of committees, and panel chairmen, is being prepared.

The leaflet *The Chairman of the Committees of RDB*, with biographical sketches of committee chairmen as of 15 March 1949, is available.

KARL T. COMPTON,
Chairman.

RESEARCH AND DEVELOPMENT BOARD

MEMBERS OF THE BOARD

Dr. KARL T. COMPTON, Chairman
Chairman of the Corporation, Massachusetts Institute of Technology

General JACOB L. DEVERS
Chief, Army Field Forces

Vice Admiral JOHN DALE PRICE
Deputy Chief of Naval Operations (Air)

Major General CHARLES G. HELMICK
Deputy Director for Research and
Development, Logistics Division
General Staff, U. S. Army

General JOSEPH T. McNARNEY
Commanding General, Air Matériel
Command, Wright-Patterson Air
Force Base

Rear Admiral ALBERT G. NOBLE
Chief, Bureau of Ordnance

Brigadier General D. L. PUTT
Deputy Chief of Staff, Matériel,
U. S. Air Force

MEMBERS OF THE EXECUTIVE COUNCIL

Dr. ROBERT F. RINEHART
Executive Secretary

Mr. F. H. RICHARDSON
Deputy Executive Secretary

Rear Admiral JOHN HAZARD CARSON
Navy Secretary

Brigadier General J. F. PHILLIPS
Air Force Secretary

Brigadier General R. W. CRICHLOW, Jr.
Army Secretary

Dr. S. D. CORNELL
Director, Planning Division

Mr. RALPH L. CLARK
Director, Programs Division

CHAIRMEN, EXECUTIVE DIRECTORS, AND PANEL CHAIRMEN OF COMMITTEES

Committee on Aeronautics

Dr. George P. Baker
Professor of Transportation
Harvard University
Graduate School of
Business Administration

(*Chairman*)

Mr. Edwin L. Zivi¹ (*Executive Director*)

Panel Chairmen

Mr. Don R. Berlin
Dr. H. L. Dryden
Mr. William C. Lawrence
Mr. Russell G. Robinson
Mr. P. B. Taylor

Committee on Atomic Energy

Mr. William Webster,² Vice President
New England Electric System

Col. J. B. Knapp³

Panel Chairman

Dr. C. P. Boner

Committee on Basic Physical Sci- ences

Dr. W. V. Houston, President
Rice Institute

Dr. Martin Grabau

Panel Chairmen

Dr. William E. Hanford
Dr. Gaylord P. Harnwell

Committee on Biological Warfare

Dr. Ira L. Baldwin, Vice President
University of Wisconsin

Dr. H. I. Cole

Panel Chairmen

Dr. Ira L. Baldwin
Dr. Kenneth F. Maxcy

Committee on Chemical Warfare

Dr. W. Albert Noyes, Jr.
Professor of Chemistry
University of Rochester

Dr. Harlan N. Worthley

Panel Chairman

Dr. Randolph T. Major

Committee on Electronics

Mr. D. A. Quarles, Vice President,
Bell Telephone Laboratories, Inc.

Mr. Edwin A. Speakman

Panel Chairmen

Mr. J. F. Byrne
Mr. F. J. Gaffney
Dr. Ivan A. Getting
Mr. F. J. Given
Dr. A. G. Hill
Mr. Hugh S. Knowles
Dr. James S. Owens
Mr. Haraden Pratt
Prof. A. L. Samuel
Dr. H. M. Trueblood
Dr. L. C. Van Atta

Committee on Equipment and Ma- terials

Mr. E. P. Brooks

Vice President in Charge of Factories
Sears, Roebuck & Co.

Mr. E. Bryan Williams

Panel Chairmen

Mr. Carl L. Bausch
Dr. Kenneth H. Condit
Dr. L. E. Grinter
Mr. Meyer Kestnbaum
Mr. E. J. McMahon
Mr. David C. Prince
Mr. H. C. Ramsey
Mr. Thomas M. Rector
Dr. H. Foster Robertson

¹ Acting Executive Director.

² Chairman of the Military Liaison Committee of the Atomic Energy Commission.

³ Secretary of the Military Liaison Committee of the Atomic Energy Commission.

Committee on Fuels and Lubricants

Mr. W. M. Holaday
Director of Research
Socony-Vacuum Oil Co.
Mr. Donald B. Brooks

Committee on Geophysics and Geography

Dr. W. E. Wrather, Director
U. S. Geological Survey
Dr. H. E. Landsberg
Panel Chairmen
Dr. Henry Houghton
Dr. C. F. Jones
Dr. Philip Kissam
Dr. J. B. Macelwane
Dr. Walter H. Newhouse
Dr. Louis O. Quam
Dr. A. C. Redfield
Dr. Philip C. Rutledge
Dr. Lorenz G. Straub
Dr. E. H. Vestine
Dr. A. Lincoln Washburn

Committee on Guided Missiles

Dr. Clark B. Millikan,
Acting Director of the Guggenheim
Aeronautical Laboratory, California
Institute of Technology
Mr. Fred A. Darwin
Panel Chairmen
Dr. J. C. Boyce
Dr. C. C. Furnas
Mr. R. R. Gilruth
Dr. George L. Haller
Mr. Wilbur S. Hinman, Jr.
Dr. A. Kossiakoff
Mr. Edwin A. Link
Dr. William H. Pickering
Dr. R. W. Porter
Mr. Harry Sutton
Dr. M. J. Zucrow

Committee on Human Resources

Dr. Donald G. Marquis, Chairman
Department of Psychology
University of Michigan
Dr. Raymond V. Bowers
Panel Chairmen
Mr. Charles Dollard
Dr. Philip M. Hauser
Dr. Lyle H. Lanier
Dr. Robert L. Thorndike
Dr. Harold G. Wolff

Committee on Medical Sciences

Dr. Francis G. Blake
Sterling Professor of Medicine
Yale University
Dr. Joseph F. Sadusk, Jr.
Panel Chairmen
Dr. Joseph C. Aub
Dr. E. J. Baldes
Dr. Frank B. Berry
Dr. Eugene F. DuBois
Dr. Carl F. Schmidt

Committee on Navigation

Dr. M. J. Kelly
Executive Vice President
Bell Telephone Laboratories, Inc.
Mr. W. J. Merchant
Panel Chairmen
Mr. C. M. Jansky, Jr.
Mr. A. G. McNish
Mr. Wilbur L. Webb

Committee on Ordnance

Mr. F. C. Crawford, President
Thompson Products, Inc.
Mr. R. B. Wright
Panel Chairmen
Dr. R. W. Cairns
Mr. L. W. Fischer
Mr. John C. Miller
Mr. Robert F. Nelson
Mr. F. L. Snyder
Mr. J. R. Townsend
Mr. Fordyce E. Tuttle

Special Committee on Technical Information

Dr. Detlev W. Bronk, President

John Hopkins University

Mr. Norman T. Ball

Panel Chairmen

Mr. John C. Green

Dr. Chauncey D. Leake

Dr. J. Murray Luck

RESEARCH AND DEVELOPMENT BOARD

HISTORICAL BACKGROUND AND OVER-ALL FUNCTIONS

The Research and Development Board, authorized by section 214 of the National Security Act of 1947, was formally set up within the National Military Establishment upon appointment by the President of Dr. Vannevar Bush as Chairman on 30 September 1947. Following the resignation of Dr. Bush on 15 October 1948, Dr. Karl T. Compton became the second Chairman.

In addition to the civilian Chairman, the Board is composed of two representatives each from the Departments of the Army, Navy, and Air Force who are designated by the Secretaries of their respective Departments.

Under the provisions of the National Security Act the Board is directed:

"(1) to prepare a complete and integrated program of research and development for military purposes;

"(2) to advise with regard to trends in scientific research relating to national security and the measures necessary to assure continued and increasing progress;

"(3) to recommend measures of coordination of research and development among the military Departments, and allocation among them of responsibilities for specific programs of joint interest;

"(4) to formulate policy for the National Military Establishment in connection with research and development matters involving agencies outside the National Military Establishment;

"(5) to consider the interaction of research and development and strategy, and to advise the Joint Chiefs of Staff in connection therewith; and

"(6) to perform such other duties as the Secretary of Defense may direct."

The directive¹ outlining the terms of reference under which the RDB operates was approved by the Secretary of Defense on 18 December 1947.

The RDB was preceded by an earlier agency, the Joint Research and Development Board, which had been organized directly under the Secretaries of War and the Navy by charter 6 June 1946 to coordinate the research programs of the War and Navy Departments and to carry on some of the functions of the Joint Committee on New Weapons and Equipment of the Joint Chiefs of Staff, which it superseded.

The organizational structure of the RDB is similar to that of the former JRDB. However, the duties and responsibilities of the Board were considerably broadened under the National Security Act of 1947. In addition to its coordinating and allocating functions, the Board was charged with the responsibility of preparing a complete and integrated program of research and development for military purposes and of advising the Joint Chiefs of Staff regarding the relationship of research and development with strategy. The Board's responsibilities were further amplified by the directive which the Secretary of Defense issued to it on 18 December 1947. This

¹ RDB 1/5.

directive authorizes the RDB to act for the Office of Secretary of Defense on all research and development matters except those involving major policy.

The major supporting agencies of the Board are:

(1) *Committees and panels* to consider specific problems in the many fields of science and weapon technology. Generally, the objective of committees is the continuing study, evaluation, improvement and allocation of the broad problems and programs of research and development in relation to the over-all aims of the national defense effort and to the available and potential store of scientific information, personnel and facilities, leading to the formulation of integrated programs in the respective fields. The work of each committee and its panels is implemented by a committee secretariat consisting of an executive director and representatives from each of the three military Departments, along with professional and other personnel necessary to perform the staff work incidental to the discharge of its responsibilities.

(2) *The Secretariat of the Board* to provide executive and administrative action required in the conduct of the Board and in the implementation of policies and directives in accordance with approved procedures. The Secretariat consists of the Executive Secretary, the Deputy Executive Secretary, and the three military secretaries of the Board, together with two supporting divisions: the Planning Division and the Programs Division. The Executive Council, consisting of the five secretaries of the Board and the directors of the Planning and Programs Divisions, aids and advises the Executive Secretary and acts as a board of review of committee actions to assure that assignments have been fully completed.

FUNCTIONS OF THE COMMITTEES

Committee on Aeronautics

The principal function of the Committee on Aeronautics is to explore new possibilities in the general aviation field and to coordinate the efforts of the three military Departments toward investigating such possibilities and developing new and improved aerial weapons. To this end it must establish a unitary program of research and development in the aeronautical field and maintain a continuing evaluation of budgetary projects to implement that program.

Committee on Atomic Energy

The purpose of the Committee on Atomic Energy is to assist the Board in connection with atomic energy aspects of the Board's complete and integrated program of research and development for military purposes. Since the Committee is composed of all the members of the Military Liaison Committee of the Atomic Energy Commission, together with civilian scientists, coordination of research and development activities of the National Military Establishment with those of the Atomic Energy Commission and the integration of such activities with all other matters relating to atomic energy are facilitated.

Committee on Basic Physical Sciences

The Committee on Basic Physical Sciences evaluates Service programs of research and development in the fields of mathematics, physics, mechanics, chemistry, and metallurgy, the latter two fields including the development of basic metallic and nonmetallic materials and substances. Its field also includes analogue and digital computing devices designed for rapid, large-scale computation, as well as the related development of mathematical formulations of large problems.

Committee on Biological Warfare

The Committee on Biological Warfare is concerned with research and development related to biological warfare in the interests of national defense.

Committee on Chemical Warfare

The Committee on Chemical Warfare is responsible for a continuous survey of research and development activities both within and without the National Military Establishment in the field of chemical warfare, including toxic agents, screening smokes, flames, incendiaries, specialized weapons and munitions for their use, and techniques of protection of both the military and civilian populations. The

Committee, aided by its panels and special consultants, is responsible also for the preparation of an integrated program of research and development in the field of chemical warfare for military purposes.

Committee on Electronics

The Committee on Electronics evaluates and coordinates the research and development programs of the three Departments in the field of electronics, including radar, communications, electron tubes, infrared, acoustics, countermeasures, interference reduction, and propagation. The Committee periodically presents to the Board its recommendations concerning the research and development programs and facilities under its cognizance including means whereby maximum advantage may be taken of new advances in the art. The Committee also recommends to the Board allocations of responsibility among the military Departments for research and development programs in its field. The elimination of waste, neglect, and unjustifiable duplication is given constant consideration.

Committee on Equipment and Materials

The Committee on Equipment and Materials is responsible for the continuous survey, analysis, and evaluation of all research and development activities, both military and civilian, of interest to the National Military Establishment in its field; for coordination of Army, Navy, and Air Force research and development programs in its field; and for the preparation of an adequate integrated program covering the needs of the three Departments. The field of interest of the Committee shall include techniques, materials, components, instrumentation, and equipments pertaining to: photography and optics; food, considered as packaged items, except in its nutritional aspects; clothing and personal equipment; camouflage; service and maintenance; rescue and salvage; generation, storage, and use of electricity; heavy equipment for earth moving and stabilization, and special purpose vehicles; packing, packaging, and preservation; mechanical equipment; and organic, inorganic, and fibrous materials, and minerals in aspects pertaining to their manufacture, testing, and applications for use.

Committee on Fuels and Lubricants

The Committee on Fuels and Lubricants is concerned with the study, evaluation, collation, and coordination of research and development activities of the National Military Establishment, which pertain to fuels and lubricants derived from natural and synthetic sources, except those depending on nuclear energy. The field of fuels and lubricants to be considered by this Committee includes organic and inorganic liquids, solid, and gaseous fuels; lubricating agents; hydraulic fluids; instrument oils; and antifreeze compounds; as well as equipment and techniques for their production, storage, handling, and dispensing. The objective of this Committee is to implement the policies and directives of the Research and Development Board in the field of fuels and lubricants and related subjects.

Committee on Geophysics and Geography

The Committee on Geophysics and Geography plans, evaluates, and coordinates Service programs relating to the earth sciences, including such important studies as weather and climate, strategic minerals, water supplies and contamination, and studies of the ocean, its circulation, and the structure of the ocean floor. The Committee also considers exploratory expeditions and other types of field research and the geographical nature and use of areas of the earth's surface with emphasis on the effect of physical and cultural elements of the environment on man and his activities. Other subjects within its purview include map content and coverage, the discovery and availability of natural resources of known or potential strategic interest, and the instruments and techniques employed for the study and elucidation of these subjects. Liaison is maintained with other government agencies, academic institutions, and industrial establishments interested in research and development activities in geophysics and geography.

Committee on Guided Missiles

The Committee on Guided Missiles is responsible for the preparation of an integrated national program of research and development in the field of guided missiles and for coordination of the work of the three military Departments to this end. Aided by its panels and special consultants, the Committee studies the actual and potential technical contributions of existing guided missile and related projects, intelligence information on foreign developments, future technical probabilities leading to the establishment of reasonable performance goals, and questions of suitable and necessary facilities to support the entire program. Recommendations are made regarding the effort necessary in the related scientific fields of aerodynamics, propulsion, guidance, control, warheads, fuzes, launching, and range instrumentation to the end that a proper balance in emphasis will be achieved in an over-all program of guided missile research and development that is sound from military, technical, and budgetary standpoints.

Committee on Human Resources

The Committee on Human Resources is responsible for surveying, evaluating, and coordinating all aspects of research and development in the Military Establishment relating to human behavior and problems of manpower, and for preparing annually an integrated program of military research activities in these fields. Through appropriate panels it studies programs and projects in the following areas: human engineering and psychophysiology, including human factors in the design and operation of equipment, sensory and motor functions and skills, and the influence of the military environment on these; assessment, assignment, and training of personnel, and the maintenance of personal adjustment; manpower requirements, resources, and mobilization methods, and problems concerning scientific and specialized personnel; social and psychological aspects of military morale and leadership, military government, psychological warfare, strategic planning and intelligence, and civil defense.

Committee on Medical Sciences

The Committee on Medical Sciences is responsible for a continuous survey, analysis, and evaluation of all research and development activities, both military and civilian, of interest to the National Military Establishment in the following areas: research in the entire field of aviation medicine; research in shipboard and submarine medicine; research in physiology, including the measurement and description of the individual's normal physiological capacities and limitations, reactions to environment, and requirements for food, water, and clothing, as well as the developmental problems pertinent to the practical application of these principles in the military field; research in the field of psychiatry, particularly mental hygiene for the prevention of psychiatric casualties and mental psychiatric rehabilitation; and research in the medical aspects of atomic warfare, in conjunction with the Committee on Atomic Energy, particularly human tolerance to radiation, protection against radioactivity, decontamination of exposed individuals, and treatment of radiation casualties.

Committee on Navigation

The Committee on Navigation evaluates and coordinates the research and development planning and programs of the National Military Establishment in the field of navigation. The objectives of these research and development activities are to improve and evolve devices, systems, and techniques for air, land, and marine navigation and traffic control. In addition to the implementation of the directive of the Board in the field of navigation, the Committee is responsible for the coordination of the research and development programs of the National Military Establishment in the field of navigation with those of the Department of Commerce and the Treasury Department (U. S. Coast Guard). By joint agreement of the Secretaries of Commerce and Defense, the Committee makes recommendations with respect to research and development plans, policies, and programs for the guidance of the Air Navigation Development Board, Department of Commerce, to insure the integration of national defense and civil requirements in the development of an air navigation and traffic control system.

Committee on Ordnance

The Committee on Ordnance evaluates the research and development programs of ordnance weapons and countermeasures of the three military Departments and makes recommendations to insure that major effort is placed on the most urgent or important phases. It assesses the adequacy of the programs including the availability of technical personnel, facilities, and equipment; determines whether there are gaps in the programs, both in plan and execution; and seeks to eliminate undesirable duplication, if such should exist. The Committee's field of interest excludes atomic energy but includes other types of explosives, land or water mines, and means and devices for planting and countering them; ammunition; bombs; rockets; and projectiles (excluding guided missiles); launching devices and equipment; conventional torpedoes and tubes; depth charges and projectors; armor; guns; gun mounts;

fire-control systems; ballistics; chemical weapons; pyrotechnics; and other equipments and material identified in the field of ordnance.

Special Committee on Technical Information

The Special Committee on Technical Information promotes the effective exchange of technical information among the agencies of the National Military Establishment. It studies the problems of collecting, correlating, reproducing, and disseminating technical information potentially useful in the research and development programs of the National Military Establishment. Similar activities in other government agencies and in universities and industrial organizations are followed, and active research into the scientific bases of information organization is encouraged. The Committee will study procedures for increasing usefulness of technical reports and will recommend more effective methods as they are brought to light.

BIOGRAPHICAL NOTES

MEMBERS OF THE BOARD

KARL T. COMPTON

Chairman of the Board

Dr. Karl T. Compton was appointed by President Truman to succeed Dr. Vannevar Bush as Chairman of the National Military Establishment Research and Development Board on 15 October 1948. To undertake this assignment he resigned from the presidency of the Massachusetts Institute of Technology, a post which he had held since 1930. He remains with the Institute, however, as Chairman of the Corporation.

From 1939 to 1940, Dr. Compton was a member of the War Resources Board. One of the original members of the National Defense Research Committee, formed during 1940, he later served as Chief, Office of Field Service, Office of Scientific Research and Development, and was Chairman of the U. S. Radar Mission to the United Kingdom in 1943. His other wartime activities included membership on the Secretary of War's Special Advisory Committee on the Atomic Bomb during 1945 and the Baruch Rubber Survey Committee. He was also a member of the Scientific Intelligence Mission to Japan in 1945. In 1946 he became a member of the War Department Research Advisory Panel, Chairman of the Joint Chiefs of Staff Evaluation Board on Atomic Bomb Tests, and a member of the Naval Research Advisory Committee. He also served as Chairman of the President's Advisory Commission on Universal Training from 1946 to 1947. A member of the American Association for the Advancement of Science, Dr. Compton was president in 1935 and served on the executive committee from 1931 to 1940.

Active in many phases of the national life, Dr. Compton has been on the Board of Trustees of the Brookings Institution since 1940, of the Edison Foundation and the Ford Foundation since 1946. He is on the Board of Trustees of the Sloan Foundation and is a member of the Rockefeller Foundation. By virtue of being chairman of the Research and Development Board, he is a member of the National Advisory Committee for Aeronautics.

Dr. Compton was graduated from the College of Wooster, Wooster, Ohio, in 1908 with a Bachelor of Philosophy degree, and received a Master of Science degree from there in 1909. He received his Ph. D. degree from Princeton University in 1912.

The many honors bestowed upon Dr. Compton include a long list of honorary degrees: the Medal for Merit awarded in 1946; the Washington Award, 1947 (Western Society of Engineers); and the Marcellus Hartley Public Welfare Medal of the National Academy of Sciences, 1947. In 1948 he was made Honorary Commander of the Civil Division of the Most Excellent Order of the British Empire and Commander of the Royal Norwegian Order of St. Olav.

J. L. DEVERS
General, United States Army
Member of the Board

General Devers, chief of the Army Field Forces, has had a distinguished Army career. Just prior to Pearl Harbor, he was chief of the Armored Force at Fort Knox. In May 1943 he was named commanding general of the U. S. Forces in the European Theater. He assumed the command of the North African Theater of Operations in December 1943, becoming deputy commander-in-chief, Allied Force Headquarters; and deputy supreme commander, Mediterranean Theater of Operations, in January 1944. When the brunt of the war shifted to the European Theater, General Devers was made commanding general, 6th Army Group in France, September 1944.

He has been commanding general of the Army Field Forces (formerly Army Ground Forces) since July 1945. The headquarters of the Army Field Forces was moved in September 1946 from Washington to Fort Monroe, Va., where the General has charge of important activities relating to training and organizational planning.

CHARLES GARDINER HELMICK
Major General, United States Army
Member of the Board

Major General Helmick became Deputy Director for Research and Development, Logistics Division, General Staff, U. S. Army, in March 1949 upon completion of a tour of duty as Deputy Military Governor, U. S. Army Military Government in Korea.

In World War II General Helmick commanded the V Corps Artillery in the European campaigns of Normandy, Northern France, Ardennes, Germany, and Central Europe.

Following graduation from the United States Naval Academy in 1913 he was commissioned Ensign and shortly thereafter resigned and was appointed Second Lieutenant in the Field Artillery of the United States Army. During the first World War he served in France with the 15th Field Artillery of the Second Division in the Aisne-Marne offensive and the Marne defensive. He served in various Field Artillery commands and in the War Department General Staff in 1933-37 and 1941-42.

ALBERT GALLATIN NOBLE
Rear Admiral, United States Navy
Member of the Board

Rear Admiral Noble was graduated from the U. S. Naval Academy in March 1917. After graduation he joined the U. S. S. *Delaware*, which operated with the British Grand Fleet during World War I. He served on that battleship until June 1921. Following study in ordnance engineering at the Postgraduate School, Annapolis, and at the Massachusetts Institute of Technology, he received the Master of Science degree in mechanical engineering in 1923 from M. I. T.

Admiral Noble was with the fleet from 1924 until 1940, commanding the destroyers U. S. S. *Dallas* and U. S. S. *Cassin*, among other assignments. From 1940 to 1943 he served in the Bureau of Ordnance, and then assumed command of the cruiser U. S. S. *Phoenix*. During 1944 he served as chief of staff to the commander of the Seventh Amphibious Force.

In January 1945, he was assigned command of Amphibious Group Eight with the Pacific Fleet, which carried out operations for the capture of Mindanao in the Philippines; and Balikpapan, Borneo.

Admiral Noble commanded the Amphibious Task Force which landed the First Corps, U. S. Army, in occupation at Wakayama, Honshu Island, in September 1945. In November 1945, he reported to the Seventh Fleet for duty in China, in support of the Korean occupation. He assumed the position of Chief of Ordnance in September 1947.

JOHN DALE PRICE

Vice Admiral, United States Navy

Member of the Board

Vice Admiral Price, deputy chief of Naval Operations (Air) since January 1948, has served continuously with naval aviation since 1920. Early in World War II he assumed command of the Naval Air Station, Jacksonville, Fla., and in 1943 was ordered to duty as commander, Fleet Wing Two, which participated in the Marshall Islands campaigns.

In April 1945 he assumed command of Fleet Air Wing One which employed the "Bat" (the first fully automatic guided missile to be used successfully in combat by any nation). In July 1945 Admiral Price was ordered to duty as commandant, Naval Operating Base, Okinawa, and military governor, Okinawa, and in February 1946 returned to the United States as commander, Fleet Air, Alameda, Calif. On 31 August 1946, he became commander, Air Force, Pacific Fleet, and on 19 January 1948 became deputy chief of Naval Operations (Air).

Following flight training in 1920, Admiral Price served in various commands, including McCook Field, Dayton, Ohio, where he was naval representative in aviation experiments and in 1922 was designated inspector of naval aircraft. In 1923, while in command of the airplane D. H.-6377, he broke existing flight endurance records, and in 1925 he was commended by the Secretary of the Navy for experimental flying aboard the aircraft carrier U. S. S. *Langley*.

Admiral Price holds the Navy's highest award, the Navy Cross, as well as the Distinguished Flying Cross and two Combat Legions of Merit.

JOSEPH T. McNARNEY
General, United States Air Force
Member of the Board

General McNarney, commanding general, Air Matériel Command, Wright-Patterson Air Force Base, Dayton, Ohio, has served more than thirty years with the United States Air Force and is a combat veteran of both world wars. In January 1942 General McNarney was appointed chairman of a War Department committee to effect a reorganization of the Army, and in the following March was designated deputy chief of staff of the United States Army.

Named deputy supreme allied commander in the Mediterranean Theater of Operations and commanding general of the United States Army Forces in that theater in October 1944, he became acting supreme allied commander in the Mediterranean Theater in September 1945. The following December he succeeded General of the Army Dwight D. Eisenhower as commanding general of the U. S. Forces in the European Theater and commander-in-chief of the U. S. Forces of Occupation in Germany. On 15 March 1947, General McNarney became senior member of the United Nations Military Staff Committee, with headquarters in New York City. He was assigned as commanding general, Air Matériel Command, on 1 October 1947.

D. L. PUTT
Brigadier General, United States Air Force
Member of the Board

Brigadier General Putt, Director of Research and Development at Air Force Headquarters since September 1948, has served in the Air Force since May 1928. He was appointed a deputy member of the Research and Development Board in September 1948, serving in this capacity until March 1949, when he became a member of the Board. In December 1946 he became Deputy Chief of the Engineering Division, Air Matériel Command, at Wright-Patterson Air Force Base, a post which he held until assuming his present duties at Air Force Headquarters. In October 1945 he was appointed Deputy Commanding General for Intelligence, Air Matériel Command, Wright-Patterson Air Force Base.

He served overseas from January to June of 1945, first as Director of Technical Services of the Air Technical Service Command in Europe, and later as officer in charge of the Hermann Goering Aeronautical Research Establishment in Brunswick, Germany. From June 1938 until his assignment overseas General Putt was stationed at Wright Field, where he was Chief of the Bombardment Branch, Engineering Division. In this position he supervised the initiation, development, and procurement of all Army Air Force experimental bombardment aircraft.

General Putt received his B. S. degree in electrical engineering from Carnegie Institute of Technology, and his M. S. degree in aeronautical engineering from California Institute of Technology. He is a member of the National Advisory Committee for Aeronautics.

MEMBERS OF THE EXECUTIVE COUNCIL

ROBERT F. RINEHART

Executive Secretary of the Board

Dr. Rinehart, who is on leave from the Case Institute of Technology, Cleveland, Ohio, where he is a Professor of Mathematics, came to the Board in July 1948 as Director of the Planning Division, a position which he held until becoming Executive Secretary in February 1949.

During the war, Dr. Rinehart was with the Office of Field Service, Office of Scientific Research and Development as a member of the Operations Research Group, which was engaged in scientific and mathematical analysis of problems of naval tactics and strategy, principally in submarine and antisubmarine warfare. Joining the group in April 1942, he served as its representative to the staff of the Commander, Caribbean Sea Frontier, and later as the leader of a group on the staff of the Commander, Submarine Force, Pacific Fleet, initiating the first operations research work in prosubmarine warfare. In April 1945 he was placed in charge of the Washington branch of the Submarine Operations Research Group.

Among awards Dr. Rinehart received for his war work are the Medal of Freedom from the War Department in 1946 for his work in antisubmarine warfare in the Caribbean Area, and the Medal for Merit for his work with the Submarine Force.

He received his Ph. D. degree in mathematics from Ohio State University.

FRANCIS H. RICHARDSON

Deputy Executive Secretary of the Board

A staff member of the Radiation Laboratory of the Massachusetts Institute of Technology, Mr. Richardson actively participated in the original development of radar equipment. In 1942, with the rank of colonel, he was assigned the responsibility for staff supervision of electronics research for the Army Air Forces. Upon separation from the Army in 1946, Mr. Richardson became director of the Cambridge Field Station, an Army Air Corps installation engaged in electronics research. In November 1946 he became administrative secretary for the Joint Research and Development Board, continuing with the Board following its reorganization under the National Security Act of 1947 as deputy executive secretary.

A Canadian by birth, Mr. Richardson served in World War I as an RAF pilot. He holds a degree in engineering from the University of Edinburgh, Scotland.

ROBERT WILLIAM CRICHLGW, JR.

Brigadier General, United States Army

Army Secretary of the Board

Brigadier General Crichlow has served almost continuously with the Coast Artillery Corps during his Army career. From 1932 until 1936 he served as instructor in antiaircraft gunnery at the Coast Artillery School, Fort Monroe, Va. In September 1939 he was designated a member of the Coast Artillery Board at Fort Monroe and served in that capacity until July 1942 when he became president of the Anti-aircraft Artillery Board, Camp Davis, N. C. In April 1943 he assumed command of the 57th Anti-aircraft Brigade, Camp Haan, Calif. He was appointed assistant chief of the Requirements Section, Headquarters, Army Ground Forces in March 1944. In September 1945 General Crichlow was designated assistant chief of staff, G-5, USASCOM "C" Yokohama, Japan, becoming deputy commander and chief of staff in December 1945. In March 1946 he assumed command of Kobe Base, Kobe, Japan. Upon his return to the United States in April 1948 he was designated Army secretary of the Research and Development Board.

JOHN HAZARD CARSON

Rear Admiral, United States Navy

Navy Secretary of the Board

From July 1944 to June 1946 Rear Admiral Carson commanded the U. S. Naval Torpedo Station, Newport, R. I., upon which the Bureau of Ordnance conferred the "Naval Ordnance Development Award" in recognition of the distinguished service of the station in the research and development of naval ordnance. On 27 July 1946 Admiral Carson assumed command of Transport Squadron One, Amphibious Forces, Pacific Fleet, and during November and December units of this squadron participated in the first full scale peacetime amphibious training exercises. In February 1947 Admiral Carson reported to duty as commander, Cruiser Division 15, U. S. Pacific Fleet, and on 15 March 1948 was designated Navy secretary of the Research and Development Board.

Admiral Carson served in World War I and has served in all types of naval vessels in various capacities. Following World War I he completed a postgraduate course in ordnance and obtained a Master of Science degree at the Massachusetts Institute of Technology. He served two tours of shore duty at the Naval Proving Ground, Dahlgren, Va. On 31 January 1941 he reported for duty as operations officer on the staff of the Commander, Cruisers, Battle Force, and was serving in this capacity, aboard the U. S. S. *Honolulu* during the Pearl Harbor attack; then he served with southwest Pacific forces in Australian waters for fifteen months. In 1943 he assumed command of the cruiser U. S. S. *Boston* which joined the famous Task Force 58 in the Pacific in January 1944.

JAMES F. PHILLIPS
Brigadier General, United States Air Force
Air Force Secretary of the Board

Brigadier General Phillips has long been associated with military aeronautical research and development. From 1929 to 1935 he was engaged in experimental work in aerial photography and mapping at Wright Field, Dayton, Ohio. Following duty with the Air Corps Detachment CWS Research and Development at Edgewood Arsenal and on engineering and technical inspection at Kelly Field, Tex., from 1937 to 1940, he served until August 1945 as staff officer in A-4, Air Corps headquarters, his special concern being staff supervision of Air Corps research and development activities and the production of aircraft. On completion of this assignment he became commanding general, Philippine Air Matériel Area, Nichols Field, and in September 1946 became assistant chief of staff, A-4, Pacific Area Command, Tokyo, Japan.

Upon his return to the United States, General Phillips was assigned as assistant chief, Procurement Group, S. S. & P. Division, Army General Staff, serving in this capacity from March 1947 until he assumed the duties of Air Force secretary of the Research and Development Board on 16 December 1947.

S. D. CORNELL
Director of the Planning Division

Dr. Cornell, director of the Planning Division, has been associated with the Board since November 1946 as a member of the Planning Division and for a short while as acting executive director of the Committee on Guided Missiles. He came to the Board from the Joint Chiefs of Staff, where he was deputy secretary of the Committee on Guided Missiles.

During the war he was on active duty with the Navy and was assigned to the Headquarters of the Commander-in-Chief, United States Fleet, and the Office of the Chief of Naval Operations. In these assignments he was concerned with the development and production of an antiaircraft tracer fire-control trainer, known as Gunner Trainer Mark 1, and in new weapons research and development. Entering on duty as a lieutenant (j. g.) he rose to the temporary rank of commander before returning to inactive duty in 1946.

Dr. Cornell was graduated from Yale University, *magna cum laude*, with honors in physics. He held a Sloane-Silliman graduate fellowship at Yale for three years, receiving his Ph. D. in physics in 1938. From 1938 to 1942, he was a physicist in the Development Department of the Eastman Kodak Company.

RALPH L. CLARK
Director of the Programs Division

Mr. Clark was called to active duty with the Navy in 1942 and was assigned Head of the Countermeasures Section, Electronics Division, Bureau of Aeronautics. Upon his return to inactive duty in 1946, he joined the secretariat of the Joint Research and Development Board as it was being organized, and has been in the position of Director of the Programs Division since the Board's inception, continuing when the Board was reconstituted under the National Security Act of 1947.

In 1930 Mr. Clark, who is a graduate in electrical engineering of Michigan State College, was appointed radio inspector with the Radio Division of the Department of Commerce and later served in this capacity with the Federal Radio Commission, and Federal Communications Commission in Detroit, Mich. In 1935 he transferred to Washington, D. C., as radio engineer with the Broadcast Division, Engineering Department, Federal Communications Commission.

Mr. Clark became a partner in the firm of Ring and Clark, Consulting Radio Engineers in 1941, leaving in 1942 to enter military service.

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